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METHOD OF TESTING THE CAPACITY OF FRUIT AND VEGETABLE CONTAINERS UNDER THE UNITED STATES STANDARD CONTAINER ACTS

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The United States standard container act of 1928, which establishes standards for hampers, round stave baskets, and splint baskets, completes the standardization of baskets begun by the standard container act of 1916. Both laws place upon the United States Department of Agriculture the duty of making capacity tests of baskets to determine whether they comply with the law. Since many of the States either have laws on the subject or have conferred upon some State department the authority to promulgate regulations establishing standard containers, the method and apparatus used by the Federal department in making tests becomes of general interest.

METHOD AND APPARATUS

The bulk-for-bulk method is used, and this restatement of the method is made in the hope that it may assist in bringing about uniformity of practice on the part of State and Federal officials who have such work to do. The equipment consists of a cabinet, a hopper funnel, a set of standard measures, a glass graduate, a scoop, a supply of clean rapeseed, all of which are shown in Figure 1, and a strickle or striking stick, a supply of gummed paper tape, and a stout knife.

The hopper funnel, which is equipped with a slide or gate at the bottom, is supported by brackets attached to a rack that moves up and down in a frame to which is affixed a graduated scale. The scale

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is useful in arranging for the proper distance of fall of the rapeseed into baskets of various sizes. As supplied by the manufacturers, the baseboard has attached to it a ring which holds the excess seed that fall from the basket when it is struck off. The baseboard is hinged so that it may be tilted to remove the excess seed and is provided with a stop to hold it in place when raised. The hinges

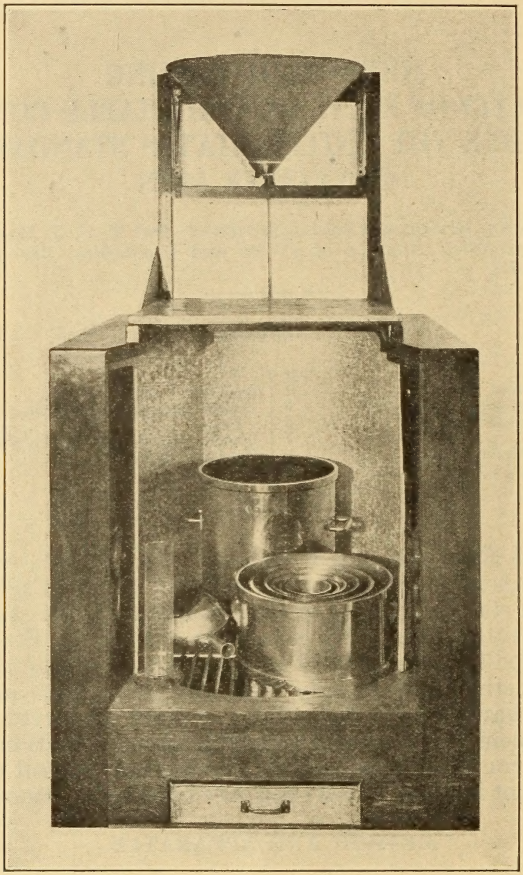

FIGURE 1.—Testing apparatus used by the United States Department of Agriculture in its work relating to the enforcement of the standard container acts of 1916 and 1928

are such that the baseboard can be easily removed and large baskets placed underneath for testing.

The hopper funnel should be mounted on an open-top cabinet, which is used in the testing of the larger baskets. (Figs. 2 and 3.) The storage cabinets with double doors furnished by manufacturers of office equipment serve this purpose fairly well. The Department of Agriculture has used successfully a specially built cabinet somewhat larger than the ordinary storage cabinet. It is equipped with

one large door and is of sufficient size to be used in testing containers of 2-bushel capacity.

SPECIAL APPARATUS DEVELOPED

As the testing work of the department increased much time was saved by removing the ring from the baseboard and using pans to

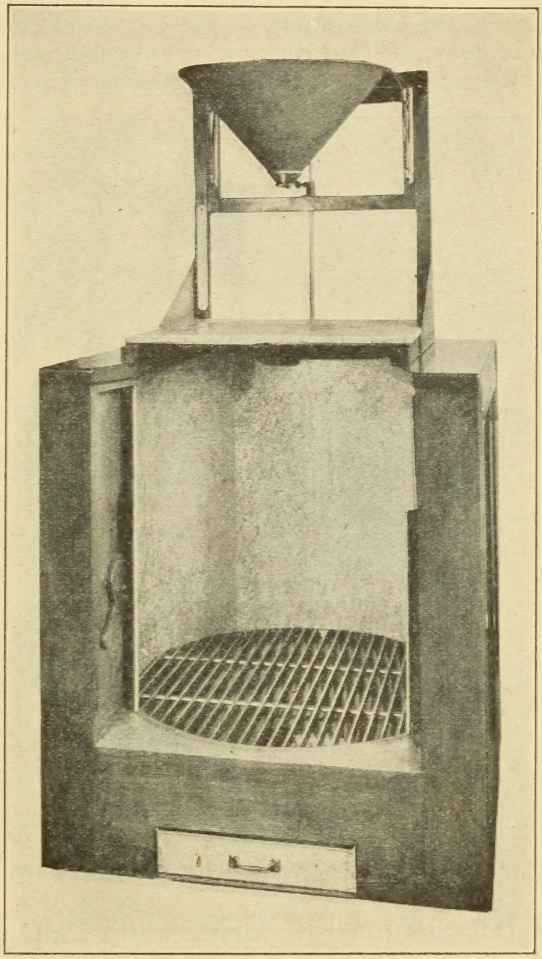

FIGURE 2.—Hopper funnel and frame mounted on special cabinet

catch the excess seed. These were made in the department shops from galvanized sheet iron. Three sizes of these pans are used, the smallest for berry boxes and small till baskets, the second size for Climax baskets and the smaller market baskets, and the third size for 16 and 24 quart market baskets. A fourth and largest pan was formerly used in the bottom of the cabinet for hampers and round stave and straight-side baskets. These pans save time, since the

excess seed can be poured direct from them into the hopper. (Fig. 4.) When the ring was used it was necessary to scrape the seed out and into some vessel from which it could be poured into the hopper.

The special cabinet and pans have proved a great convenience, as they will prove for any testing laboratory in which the work is not exceedingly heavy; but the great increase in the work of the Department of Agriculture, brought about by the passage of the standar container act of 1928, made imperative the more rapid handling of tests. As a result, the cabinet now in use was developed in the technological laboratory of the Bureau of Agricultural Economics.[1] (Fig. 2.) The floor of the cabinet is a gridiron of rectangular steel

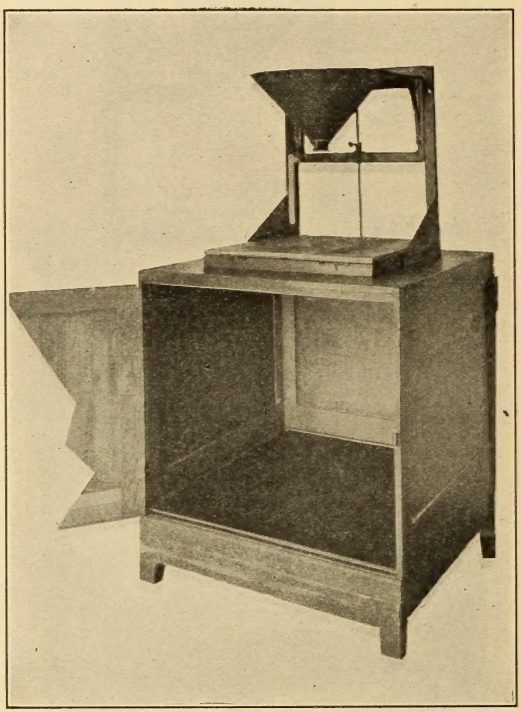

FIGURE 3.—Hopper funnel and frame mounted on old-style cabinet

bars. Below this gridiron is a funnel which leads into a small drawer. Within the cabinet is a cylinder of galvanized iron extending almost to the top of the cabinet. This cylinder is cut away in front. Two curved doors are provided; one the full height of the cylinder, and the other is approximately half the height. (Fig. 5.) In testing hampers or other high containers the higher of the two doors is used. In testing round stave or straight-side baskets, or any low container, the lower of the two doors is used to facilitate the striking off. (Fig. 6.) Doors are used to keep the seed from bouncing out of the cabinet.

[1] This cabinet was constructed by J. F. Barghausen, agricultural technologist.

The cabinet is so constructed that the front is cut away, and the front of the frame that holds the hopper funnel is also cut away. This facilitates the work of striking off tall baskets, for it is unnecessary for the operator to stoop under the top of the cabinet. When the basket is struck off the surplus seed falls through the gridiron into the drawer at the bottom. It thus becomes unnecessary to scrape or brush surplus seed off the floor of the cabinet, and as the

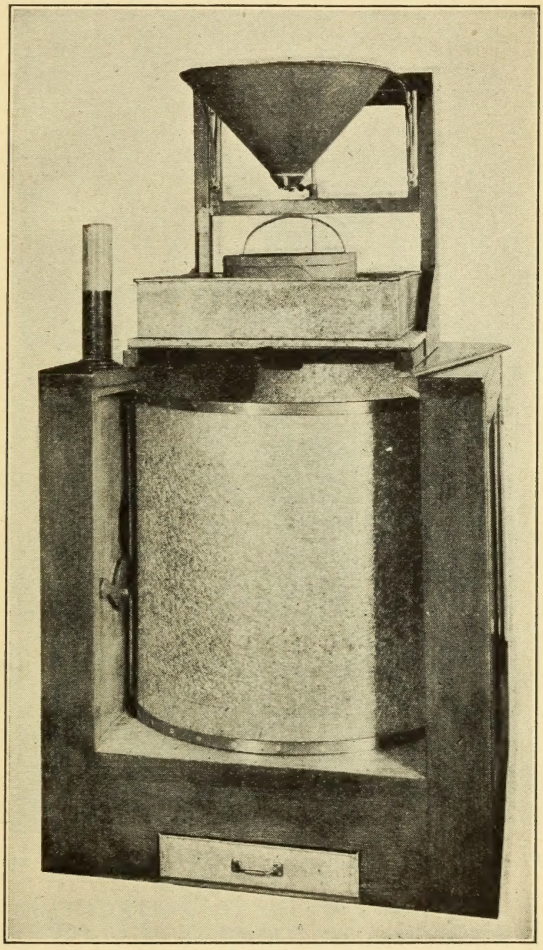

FIGURE 4.—Testing a market basket. Berry boxes and Climax and till baskets are tested in this position

drawer is much smaller than the pans in use with the other type of cabinet, it is handled with much less effort by the operator. The use of this new cabinet has speeded up the work of testing and has made it much less wearing on the operator.

STANDARD MEASURES USED

The standard measures are of nickel-plated brass and are tested and approved by the United States Bureau of Standards before

being accepted by the Department of Agriculture. They comprise a stock set of measures of the following capacities: 1 pint, and 1, 2, 4, 8, and 16 quarts. To these have been added, as the needs of the work demanded, first, a full-bushel measure, and then 12, 20, and 24 quart measures. The last three were made necessary by the United States standard container act of 1928, which includes these sizes among the standards for certain types of baskets.

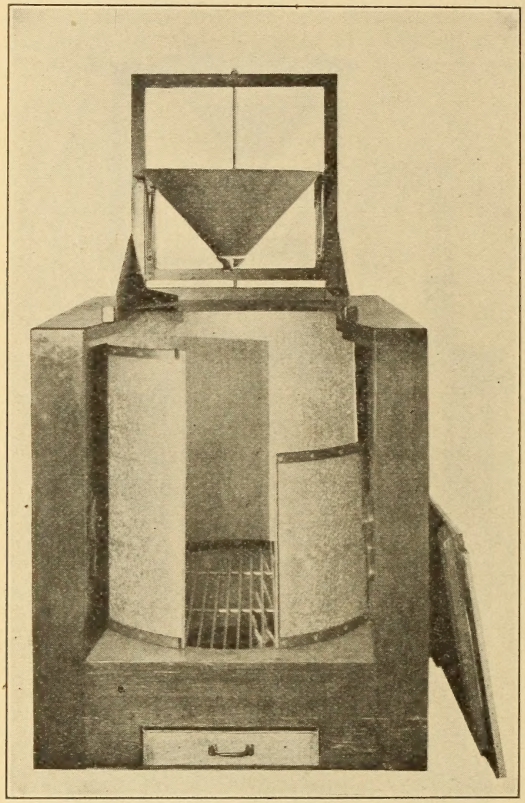

FIGURE 5.—Testing cabinet showing the two doors of different heights

The glass graduate used has a capacity of 35 cubic inches. It is graduated by one-half cubic inches, and every 5 cubic inches is marked, as are the dry one-half pint and dry pint. A graduate having a capacity of 1 dry pint would be large enough. In purchasing glass graduates consideration should be given to the height that can be used under the hopper funnel. (Fig. 7.) Some of those on the market are too high to use with the hopper owned by the department. The glass graduate is used in making the final determination of the quantity of excess or deficiency of any basket and is also used for testing ½-pint berry boxes.

THE TESTING MEDIUM

The department recommends clean rapeseed as a testing medium. It packs well, strikes off smoothly, and gives remarkably uniform results. Dried peas have been tried by the department for the testing of bushel containers but can not be recommended, as the results obtained were not sufficiently uniform.

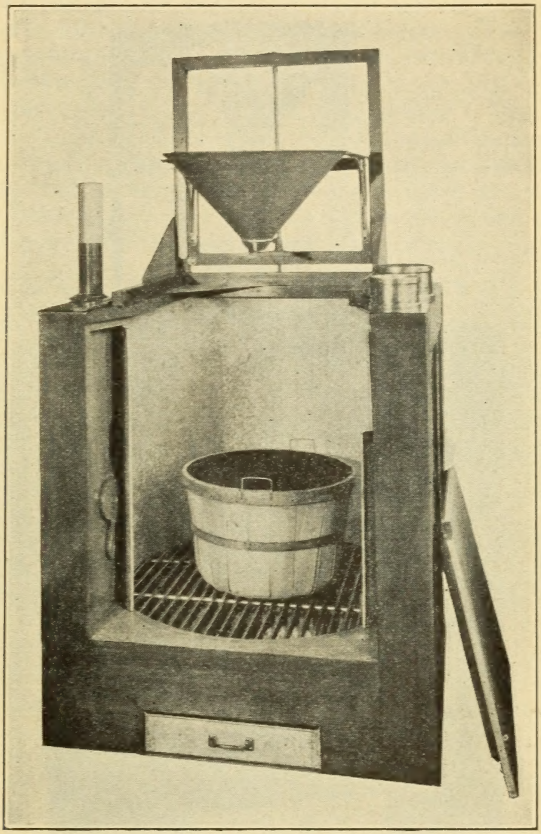

FIGURE 6.—Testing a 1-bushel round stave basket. The cabinet is used in testing all large containers

PREPARATION OF BASKETS FOR TESTING

For closing the spaces between splints, staves, or blanks, of which baskets are made, gummed paper tape is used. This tape should be made of 30 or 35 pound paper to permit its being easily worked into such spaces as those between staves of round stave and straight-side baskets. Two-inch tape is necessary for round stave and straight-side baskets and for hampers; it can be split, if desired, for the smaller containers. For hampers with wide spaces between the staves it is preferable to use 3-inch tape rather than to lap the 2-inch tape. The use of 3-inch tape will greatly expedite the preparation of splint or market baskets.

If testing work is heavy, the use of a tape-moistening machine is advised. The machine used by the department can be regulated to deliver any desired length of tape up to 16½ inches and is provided with a shear for cutting the tape, and a brush which moistens the tape as it comes out. Such a machine saves a great deal of time and applies the proper amount of moisture.

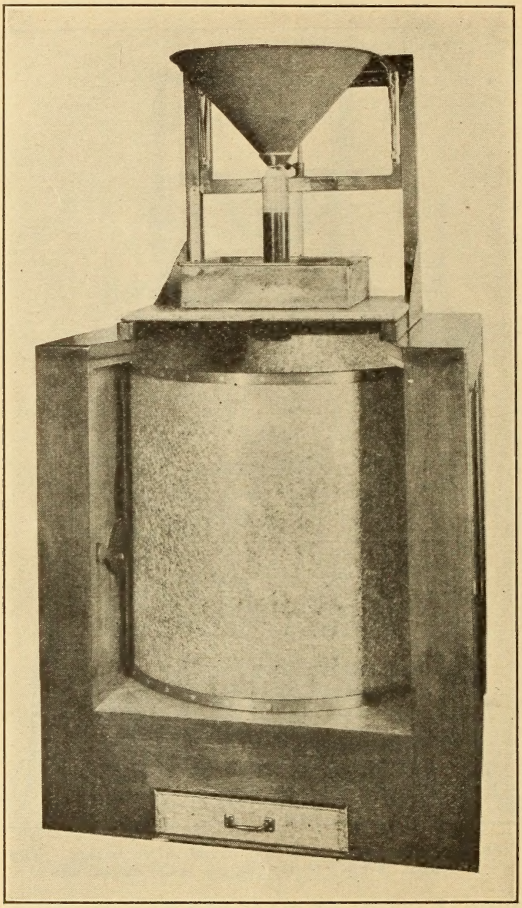

FIGURE 7.—Glass graduate in position under hopper. The pan shown in this picture is the one used in making tests of berry boxes and till baskets

If a machine of some type is not available the tape should be cut to approximately the proper lengths before work is begun. The tape may be moistened with a sponge, and each strip must be applied as it is moistened. Care must be taken not to get the tape too wet, or its adhesive quality will be destroyed.

In pasting American berry boxes and till baskets the paper is applied on the outside at the corners and also over the space where the two pieces of veneer cross each other. In the case of Climax baskets

the paper is applied on the inside along the corner between the bottom and sides of the basket and also along the spaces where the pieces of veneer that constitute the side lap over each other. With market baskets the paper is applied entirely on the outside of the basket. With hampers, a strip of paper should be pasted on the inside of the hamper over the space between staves. This paper can be of sufficient length to cover a portion of the space between the bottom and the stave, and such part of this space not covered by this strip should be covered with smaller pieces. The hole in the bottom of the hamper should be pasted over. Round stave and straight-side baskets are pasted on the inside, the paper being carefully worked down in the spaces between staves. The pasting of the bottoms of these baskets requires some care because of their peculiar and irregular shape. (Fig. 8.) With the exception of the berry boxes and till baskets, it is necessary to cover the rim of these baskets, since there is sufficient space between the inside and outside bands to hold considerable seed. Sometimes staves or splints pro-

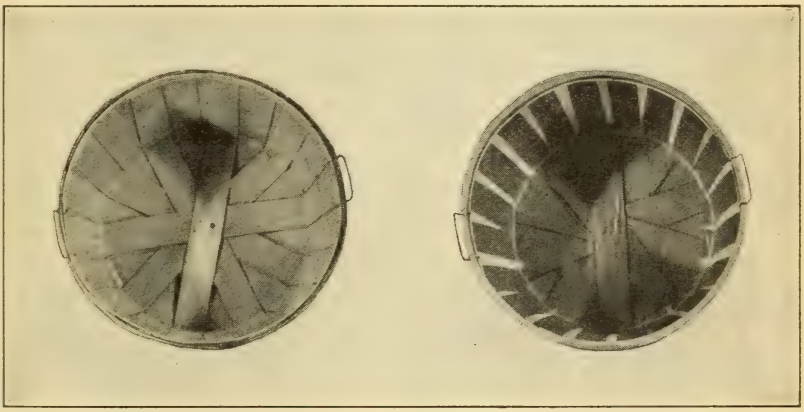

FIGURE 8.—A 1-bushel bent-bottom basket before and after being prepared for testing

trude above the top hoops of baskets in such a way as to interfere with striking off. In such cases they should be trimmed to be even with the hoops.

HOW TO MAKE A TEST

The actual process of making a test can best be explained by taking some one basket as an example, for instance, the ordinary quart berry box. More than enough rapeseed to fill the standard quart measure is poured into the hopper and allowed to pass into the standard measure. This measure is then struck off and placed at one side. The excess seed is then put in the hopper and 10 cubic inches of this seed is allowed to flow into the glass graduate. The excess seed then remaining in the hopper is run off and discarded. The 1 quart together with the 10 cubic inches of seed is then poured into the hopper, and the standard quart measure is placed underneath. The slide of the hopper is opened, and all the seed is allowed to flow into the standard measure, which is again struck off and set to one side. The excess seed is replaced in the hopper and allowed to run into the

graduate, which should then contain exactly 10 cubic inches. If the quantity of seed in the graduate is not correct it is adjusted by adding to or taking from it until it is correct; then the total quantity of seed is again placed in the hopper and run into the standard quart measure and graduate. This operation is repeated until exactly 1 quart and 10 cubic inches of seed are obtained. This seed is then put in the hopper, and the berry box to be tested is placed underneath. The seed is allowed to flow into it, falling the same distance into the box that it fell into the measure. The box is then struck off carefully.

In striking off a container care should be taken that the striking stick rests lightly on the edge of the container with its face inclined at an angle of 45° to the container, and that the container is not jarred during the process. Any jarring or rough treatment will result in settling the seed in the container and will make the test incorrect. After striking off, the container is tapped lightly to settle the seed so that none will spill when the container is lifted from beneath the hopper. If a strickle is not available, the ordinary desk ruler will serve the purpose well, provided the back or rounded edge of the ruler is used.

The overflow is poured into the hopper and allowed to run into the graduate. If the reading on the graduate shows 12 cubic inches the berry box is 2 cubic inches short, or has a capacity of 1 quart minus 2 cubic inches. If the reading shows 9 cubic inches, the box is 1 cubic inch too large, or has a capacity of 1 quart plus 1 cubic inch.

QUANTITY OF EXCESS SEED USED

The same process is used for baskets of all sizes, except that the surplus used in order to make striking off possible will be smaller or larger, depending on the capacity of the baskets to be tested and on their shape. For ½-pint containers, 20 cubic inches of seed measured into the graduate should be sufficient. The following surpluses are used in the Department of Agriculture for the given types and sizes of baskets:

Capacity of container to be tested:	Surplus seed provided
1 pint	5 cubic inches
1 quart	10 do
2-quart till	15 do
2-quart Climax	20 do
3-quart till	20 do
4-quart till	20 do
4-quart Climax	20 do
8-quarts, all types	1 pint
12 quarts, all types	1 do
16 quarts, all types	1 do
24 quarts, all types	1 quarts
1 bushel, all types	1 do
1¼ bushels, all types	2 do
1½ bushels, all types	2 do
2 bushels, all types	2 do

These quantities will be found sufficient in most cases. Some baskets run so large that they make it necessary to increase the quantity of the surplus. In the case of oblong baskets it is necessary to work the seed down into the ends of the baskets carefully before the final

striking off. This may be done by forcing the seed lightly with the striking stick from the top of the heap toward each end until the ends are fairly well filled; then the basket may be struck off. Hampers of a capacity of 24 quarts and greater, when made with the inside top hoop set with its upper edge three-eighths of an inch below the upper end of the staves, will require an additional surplus of 1 quart more than is shown above.

DETERMINING EXCESS OR DEFICIENCY OF THE LARGER BASKETS

If the surplus is 1 pint or 1 quart, the surplus is measured out in the standard pint or quart measure instead of the glass graduate; but the process of determining the correct quantity, running the seed into the basket and striking off, is the same as in the example given above. In measuring the capacity of a bushel basket, for example, if the excess struck off is greater than a quart, this excess seed is poured into the hopper and allowed to run into the quart measure, which is then struck off. The excess from this is placed in the hopper and run into the glass graduate. The reading of the glass graduate will show the amount of deficiency of the basket. Thus, a reading of 10 cubic inches would show the basket to have a capacity of 1 bushel minus 10 cubic inches.

If the excess resulting from striking off the basket is less than a quart, it is run through the hopper into the standard pint measure, which is then struck off. This excess is then run through the hopper into the glass graduate and the number of cubic inches in the glass graduate is subtracted from 33.6, the number of cubic inches in a pint, to find the excess capacity of the basket. Thus, if the glass graduate contains 20 cubic inches, this amount subtracted from 33.6 cubic inches, gives 13.6 cubic inches. The basket therefore has a capacity of 1 bushel plus 13.6 cubic inches.

Hampers that are made with the inside top hoop set with its upper edge below the upper end of the staves, ordinarily at a distance of three-eighths of an inch, are so made in order that the cover can be placed inside the staves and rest on the inside top hoop. This makes it necessary to determine the capacity of such baskets to the upper edge of the inside top hoop. The method used in such cases by the department is as follows: Find the total capacity of the hamper in the usual way. Determine the average inside top diameter of the hamper, and the average distance the inside top hoop is set down, basing these averages on a number of measurements. From these compute the number of cubic inches in the space between the upper edge of the inside top hoop and the upper ends of the staves, using the formula: Diameter squared $\times$ 0.7854 $\times$ the average depth. Deduct the result from the total capacity of the hamper as determined by the bulk-for-bulk method. The remainder is the capacity to the upper edge of the inside top hoop.

SPECIAL APPARATUS FOR CLIMAX BASKETS

It is impossible to make a satisfactory test of Climax baskets with the handles attached. Since they are ordinarily shipped with the handles in separate bundles, samples are received from the manufacturers without handles. The United States standard container

act of 1916 prescribes the outside dimensions for these baskets. To facilitate tests of these containers the department uses wooden frames, the inside dimensions of which correspond to the outside dimensions as provided by the law. (Fig. 9.) The height of these frames is a little less than the height of the baskets, that they may not interfere with striking off. The baskets are forced into the frames, any excess in length being forced into the corners of the frames. Some such arrangement for bringing the size of these baskets into the width they will have when handles are attached is necessary in order that the test may be fair. Unless this is done the spread of the basket along the sides will tend to show an excess capacity.

GENERAL CONSIDERATIONS

Emphasis should be placed on the necessity of using clean rapeseed. After the seed has been used for some time it dries; many of the seeds break open and the lot becomes more or less filled with chaff. This chaff seems to absorb considerable moisture from the air during damp weather. In testing large containers the swelling resulting from this absorbtion may be sufficient to make the test

FIGURE 9.—Frames used in making tests of Climax baskets

valueless. However, rapeseed can be used for quite a while before this trouble will arise.

In testing a small lot of baskets (three to six) it is sufficient to test the seed in the standard measure and glass graduate before and on completion of the test. If a large number of baskets are to be tested it is best to check back at intervals during the test.

The basic idea of the bulk-for-bulk method of testing a basket is that the capacity of the basket shall be compared with the capacity of standard measures of a known volume. Since this comparison is made by filling the basket with seed which has been measured in vessels of standard capacity, it is essential that the conditions under which the basket is filled be as nearly as possible like those under which the standard vessels or measures were filled. Two important factors to be kept uniform are the rate of flow of the seed and the distance the seed falls. The former is controlled by the size of the gate at the bottom of the hopper and the latter by adjusting the height of the hopper. If the seed is permitted to fall a different distance into the basket than it fell into the measure the closeness with which it packs varies and the accuracy of the test is impaired. Furthermore, all tests of containers of a given type and capacity should be made under the same conditions in order to insure that

all manufacturers are accorded the same treatment. Here also uniformity in fall of seed must be practiced.

The distance the seed falls is measured from the bottom of the hopper to the platform used on top of the cabinet, or to the bottom of the cabinet. The department's practice is that the seed shall fall 13 inches from hopper to platform in testing berry boxes, till baskets, Climax baskets, hampers up to 8 quarts, round stave and straight-side baskets up to 16 quarts, and splint baskets up to 24 quarts. Hampers larger than 8 quarts, round stave and straight-side baskets larger than 16 quarts, and splint baskets larger than 24 quarts, are placed within the cabinet for testing, and the seed falls 37½ inches, from the bottom of the hopper to the bottom of the cabinet.

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